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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,905	01/23/2004	Douglas D. Coolbaugh	BUR920030177US1	1904
29625	7590	06/28/2005	EXAMINER	
MCGUIRE WOODS LLP 1750 TYSONS BLVD. SUITE 1800 MCLEAN, VA 22102-4215			HU, SHOUXIANG	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 06/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/707,905

Applicant(s)

COOLBAUGH ET AL.

Examiner

Shouxiang Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 16-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>4/13/2005</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claims 24-26 are objected to because of the following informalities and/or defects:

In claim 24, the term of "first (or second) energy atoms" should read as: --atoms having a first (or second) energy--.

Claim 24 recites the subject matters of "doping a middle region" "with a second dopant which is tailored for an implant profile that forms an anode"; but it fails to clarify: which recite element is tailored, the middle region or the second dopant; How it is tailored; and what is the relationship between the implant profile and the doped upper region, as they both are recited to form an anode.

In claim 24, the term of "depth of" should read as: --depth in--.

Claim 24 also fails to clarify the relationship between the recited dopants and the recited atoms.

In claim 25, the term of "single dopant" should read as: --single type of dopants--

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 16-23 are rejected under 35 U.S.C. 102(b) as being anticipated by applicant's admitted prior art ("AAPA").

AAPA discloses a method of fabricating a varactor (Fig. 1), comprising: providing a semiconductor substrate (12 and 26, which can be naturally regarded as a substrate at least for the layer 34 thereon); doping a lower region (14, N+, and 16 (a collector), N; forming a cathode) of the semiconductor substrate; doping a middle region (24, N, forming an HA junction) of the semiconductor substrate; and, doping an upper region (26, P+; forming an anode) of the semiconductor substrate.

Regarding claims 21-23, the method of AAPA further comprises the steps of forming an isolating region (18), a reach-through implant (20), and a silicide layer (32).

4. Claims 16-20 are further rejected under 35 U.S.C. 102(b) as being anticipated by Kajimura (JP 4-62977, 2/27/1992; of record).

Kajimura discloses a method of fabricating a varactor (Figs. 1-3; also see its English abstract and/or titles), comprising: providing a semiconductor substrate (12 and 11); doping a lower region (11, N+, and, 12, N; naturally forming a collector/cathode) of the semiconductor substrate; doping a middle region (15, N, an HA junction) of the semiconductor substrate; and, doping an upper region (16, P+; forming an anode) of the semiconductor substrate.

5. Claims 24-26, as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(b) as being anticipated by Igarashi (Igarashi et al., JP 4-343479, 11/30/1992).

Igarashi discloses a method of fabricating a varactor (see Figs.1 and 2, also see the English abstract), wherein the remaining n-type region 6 (under the p-type region 7) comprises: a first region--the lowest region of the region 6; a second region--the low region of the region 6 that is above and in contact with the lowest region; and, a third region---an upper region of the region 6 that is above the second region (the low region) but below and in contact with the p-type-doped region 7. The method comprises: doping a lower region (the first region of 6) of a substrate layer with a first type of dopants having a dopant profile such that first-energy atoms ("A") therein penetrate to a first depth ("A' ") in the substrate layer, which naturally forms a cathode as it is n-type doped in the diode structure, and with a second-energy atoms ("B") therein penetrate to a second depth (" B' ") in the substrate layer forming a collector region (the second region of the region 6) above the cathode, wherein naturally  $A > A'$  and  $B > B'$ , and the second region of the region 6 can naturally function as a collector region as it is formed of an n-type doped region near the PN junction of the diode structure; doping a middle region (the third region of the region 6) of the substrate layer with a second type of dopants, which is naturally tailored for a to-be-implant profile that forms the anode as it is in direct contact with the to-be-formed anode region (7); and, doping an upper region (7) of the substrate layer that is naturally with a source/drain-type implantation to form the anode region (7) of the diode structure.

Regarding claim 25, the forming of the collector region and the cathode in Igarashi are naturally formed in a single doping step via energy distribution of a single type of dopants.

Regarding claim 26, the active portion of the varactor in Igarashi can be naturally regarded as being formed in a column from the substrate which is semiconductor material.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kajimura.

The disclosure of Kajimura is discussed as applied to claims 16-20 above.

Although Kajimura does not expressly disclose that the method can further comprise the steps of forming an isolating region, a reach-through implant, and/or a silicide layer, one of ordinary skill in the art would readily recognize that such steps are each common in the art for forming desired element isolation structure and/or forming contact to the collector region with reduced connection resistance, as readily evidenced in the prior art, such as in applicant's admitted prior art (see Paragraphs 0012 through 0019 of the instant specification).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the steps of forming an isolating region, a reach-through implant, and/or a silicide layer into the method of Kajimura, so that a method for forming a varactor with desired element isolation and/or with reduced connection resistance to the collector region would be obtained.

### ***Response to Arguments***

7. Applicant's arguments filed on April 13, 2005 have been fully considered but they are not persuasive.

With respect to applicant's arguments that AAPA fails to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., formed by the tail of the deep implant process; and, no additional layer is added to the top of the substrate) are not recited in the relevant rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). And, it is further noted that the term of "substrate" can be commonly interpreted as meaning: an underlying support, or, a foundation, according to Merriam Webster Dictionary. Thus, the lamination of layers 12 and 26 in AAPA can be naturally regarded as a substrate at least for the layer 34 thereon, as it can naturally function as a support and/or foundation for the overlying layer 34.

In response to arguments regarding Kajimura, it is noted that the n-type-doped regions in Kajimura comprise at least three n-type doped regions (11, 12, and 15). It

means that there are at least three doping processes involved therein, as each of the at least three doped regions requires a certain type of dopants mixed therein, regardless how is doped and in which step it is doped, and regardless whether its doping process is performed during or after the formation of the substrate, as the relevant claimed invention lacks sufficient limitations to uniquely define during which specific step in which specific process sequence each of the recited doping steps is carried out.

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

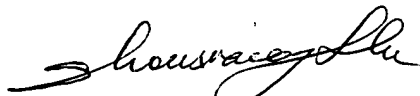


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH  
June 23, 2005



**SHOUXIANG HU**  
**PRIMARY EXAMINER**